Booster and AGS Startup with Copper for RHIC

C.J. Gardner

November 8, 2004

Caution! The following schedule is subject to change. Please note release date above.

RHIC is to begin taking beam on 15 November 2004.

1 Monday 8 November

1. Transport Cu^{11+} ions from Tandem to Booster.
2. Inject and accelerate to 3.850 MHz as per archived setup. Note that some adjustments have been made to the BMM power supply to reduce ripple.
3. AGS radiation safety checkoff list complete.
4. Setup extraction at 3.850 MHz and transport to AGS. Note that some BTA power supplies have changed.

2 Tuesday 9 November

1. Multiply L20 inflector gold archive setpoint by 3.2081/3.7216 to obtain setpoint for copper. Multiply AGS gold archive injection field by same ratio to obtain injection field for copper.
2. Inject one Booster load (6 bunches) of Cu^{29+} ions into AGS. Measure revolution frequency; this is estimated to be $3831/24 = 159.625$ kHz.
3. Allow beam to debunch; then rebunch at harmonic $h = 12$.

4. Work on acceleration to $B\rho = 81.1137824$ Tm. (The corresponding frequency is $hf = 4.4418770$ MHz).

5. Things to commission: (1) new RF hardware (voltage and phase control of individual cavities); (2) new AGS beam control application; (3) new Tune-Chrom function generators and application. Note that the horizontal sextupoles have a new bipolar power supply.

3 Wednesday 10 November

1. Setup Booster-AGS synchro with bunch-to-bucket capture at $h = 24$ on AGS injection porch.

2. Setup 4 transfers of copper to AGS per AGS cycle. Setup cogging.

3. Setup adiabatic debunch and capture at harmonic $h = 4$ on AGS injection porch. Setup "morph" to $h = 8$ and $h = 12$.

4. Accelerate the 4 bunches to top energy ($B\rho = 81.1137824$) at harmonic $h = 12$.

4 Thursday 11 November

1. Complete radiation safety checkoff items to allow extraction from AGS into U-line.

2. Multiply AGS gold archive extraction field by 81.114/83.221 to obtain extraction field for copper. The desired frequency at extraction is $hf = 4.4418770$ MHz.

3. Multiply U-line (upstream of flag UF2) gold archive setpoints by 81.114/83.221 to obtain setpoints for copper transport.

4. Setup AGS extraction and U-line transport.

5. Setup AGS transition jump. Note that for Cu^{29+} ions at transition $B\rho = 56.9$ Tm; for protons $B\rho = 26.4$ Tm; for Au^{77+} ions $B\rho = 67.1$ Tm.

6. ATR studies.

5 Friday 12 November

1. Continue AGS extraction and U-line transport work.
2. Setup W-line transport to dump.
3. AGS-RHIC synchro work.
4. Commission G10 kicker timing.
5. Commission Low Intensity Beam Inhibit system.
6. ATR studies.

6 Saturday 13 November

1. Work on anything requiring further attention.
2. Setup transport in X and Y arcs.
3. ATR studies.

7 Sunday 14 November

1. Work on anything requiring further attention.
2. ATR studies.

Table 1: Gold and Copper Parameters at Booster Injection

Parameter	Au^{32+}	Cu^{11+}	Unit
mc^2	183.45681198	58.612926983	GeV
Date	–	19 Sept 04	
11DH1 NMR Probe	5580	8499.507	Gauss
hf	397.607	650.493	kHz
h	6	6	
$T = 1/f$	15.0903	9.2238	μs
Kinetic Energy W	182.7568	156.675	MeV
$B\rho$	0.8538	1.300433	Tm
$B\rho/\rho$	615.7685	937.884	Gauss
Booster Hall Probe	5858	9166	Counts
Booster Gauss Clock	252	130	Counts
"Injection Field"	611.0	929.6	Gauss
Inflector Setpoint	21.975	55.043	kV
Inflector Predicted	22.203	55.327	kV

Table 2: Gold and Copper Parameters at Booster Extraction

Parameter	Au^{32+}	Cu^{11+}	Unit
mc^2	183.45681198	58.612926983	GeV
Date	–	–	
hf	3.842917	3.850	MHz
h	6	6	
$T = 1/f$	1.5613	1.55844	μs
Kinetic E per Nucleon	100.816	101.154	MeV
$B\rho$	9.136	8.51050963	Tm
$B\rho/\rho$	6594.35	6142.87	Gauss

Table 3: Gold and Copper Parameters at AGS Injection

Parameter	Au^{77+}	Cu^{29+}	Unit
mc^2	183.434144	58.603772735	GeV
Date	–	–	
hf	3.781006	3.831	MHz
h	6	6	
$T = 1/f$	6.347517	6.264683	μs
Kinetic E per Nucleon	97.0601	99.9763	MeV
$B\rho$	3.7216	3.2080729	Tm
$B\rho/\rho$	435.895	357.7478	Gauss

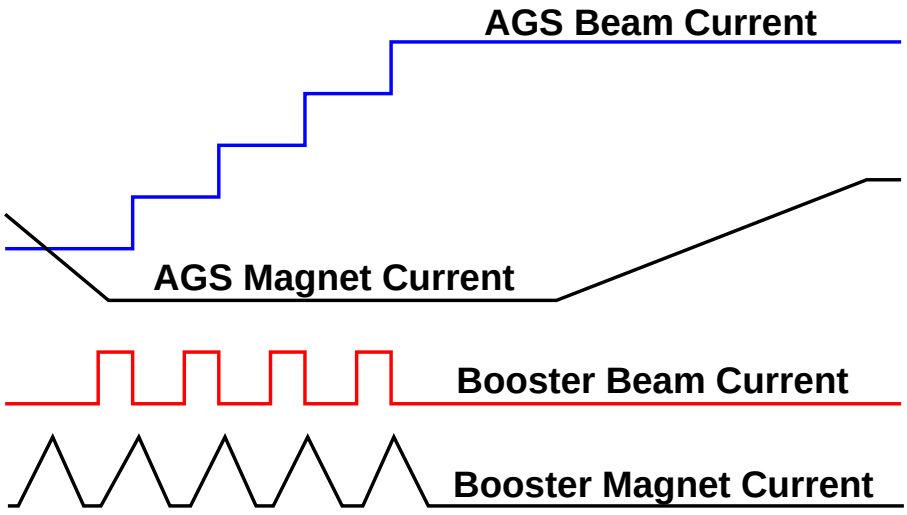

Figure 1: Timing of Booster and AGS Cycles

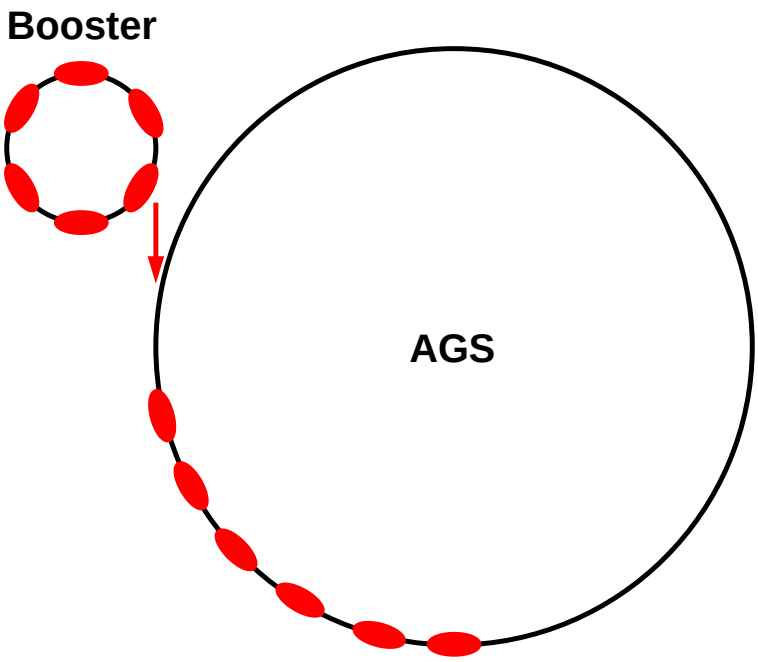

Figure 2: Transfer of One Booster Load to AGS

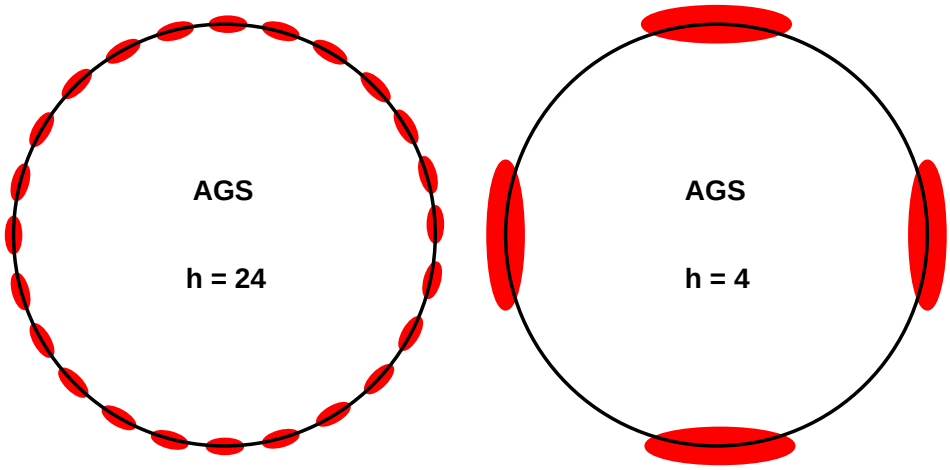

Figure 3: 24 Bunches Rebunched into Four

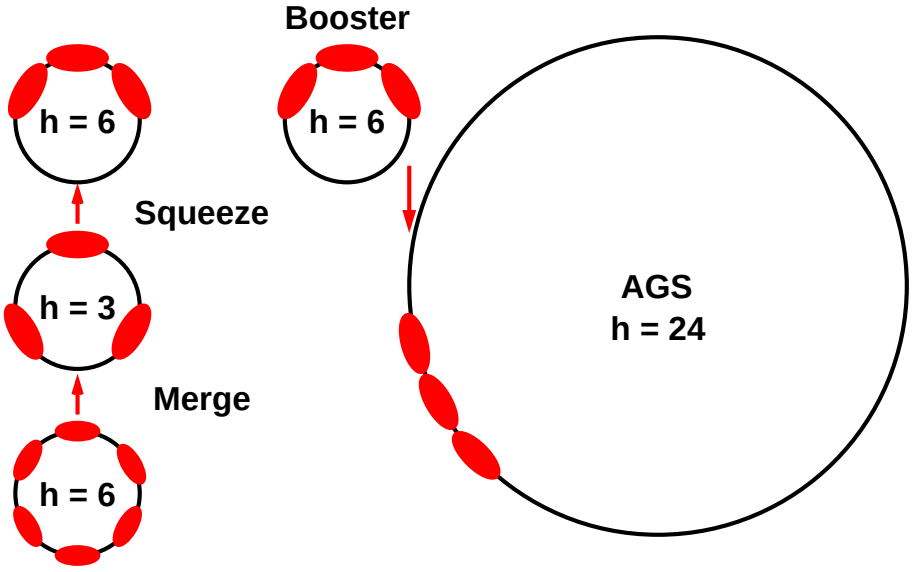

Figure 4: Booster Merge and Squeeze to Double Intensity per Bunch